

## **REMARKS/ARGUMENTS**

Claims pending in the instant application are numbered 1-30. Claims 1-30 presently stand rejected. Formal drawings are being submitted herewith. Claim 4 has been canceled herewith without prejudice. Claims 1-3, 19, 20, 21, 23, 25 and 29 have been amended herewith. The Applicant respectfully requests that the amendments presented herewith be entered and that the instant application be reconsidered in view of the amendments and following remarks.

### *Drawings*

In the August 7, 2003 Office action, new drawings are required because the application was originally filed with informal drawings. The Applicant has submitted formal drawings herewith. The Applicant respectfully requests that the formal drawings be entered and that the instant drawing objection be withdrawn.

### *Claim Objections*

In the August 7, 2003 Office action, claim "23" is objected because "line 11 of the claim recites 'coupled to receive the a plurality of optical beams.'" The Applicant believes the Examiner intended to type claim "25" instead of claim "23" because claim 25 as originally filed has the typographical error identified by the Examiner. The Applicant has amended line 11 of claim 25 as originally filed to correct this typographical error as requested by the Examiner. The Applicant respectfully requests that the instant claim objections be withdrawn.

### *35 USC § 102 Rejections of Claims*

In the August 7, 2003 Office action, claims 1, 5-8, 10, 12-14, 17, 19, 22, 24-26, 28 and 30 are rejected under 35 USC § 102(e) as being anticipated by Lundqvist, US Patent Application Publication Number 2003/0021305 A1 (hereinafter "Lundqvist").

As set forth in M.P.E.P § 2131.01, “a claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference,” *citing Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987).

Example independent claim 1 as presently amended expressly recites “the optical modulator including a plurality of capacitors having charge modulated regions in the semiconductor substrate, wherein the optical beam is directed through the semiconductor substrate and through the charge modulated regions of the capacitors, the charge modulated regions of the capacitors in the semiconductor substrate to modulate the optical beam . . .” (emphasis added).

Lundqvist is directed to a tunable semiconductor laser with an integrated wideband reflector. Although Lundqvist discloses that an extracavity device 130 may be a modulator in paragraph 49, Lundqvist fails to disclose, teach or even fairly suggest at least that the modulator includes a plurality of capacitors having charge modulated regions in the semiconductor substrate, wherein the optical beam is directed through the semiconductor substrate and through the charge modulated regions of the capacitors, the charge modulated regions of the capacitors in the semiconductor substrate to modulate the optical beam, as expressly recited in the Applicant’s presently claimed invention. Independent claims 19 and 25 as presently amended distinguish over Lundqvist for at least the same reasons as claim 1. The remaining claims are dependent claims and distinguish for at least the same reasons as their respective independent base claims, in addition to adding further limitations of their own.

Therefore, the Applicant respectfully submits that the expressly claimed invention as presently amended is not anticipated by Lundqvist because to each and every element as set

forth in the presently claimed invention is not found, either expressly or inherently, in Lundqvist. Thus, the Applicant respectfully requests that the instant section 102 rejections be withdrawn.

*35 USC § 103 Rejections of Claims*

In the August 7, 2003 Office action, claims 2-4, 9, 11, 14-16, 18, 20, 21, 23, 27 and 29 are rejected under 35 USC § 103(a) as being unpatentable over various combinations of Lundqvist, Hung US Patent Number 6,330,255 (hereinafter “Hung”), Gill US Patent Number 6,172,791 (hereinafter “Gill”), Sarlet European Patent Application Publication 1 094 574 (hereinafter “Sarlet”), Liu US Patent Application Publication Number 2002/0197011 (hereinafter “Liu”) and Kapany US Patent Number 6,480,513 (hereinafter “Kapany”).

In order to establish *prima facie* obviousness of a claimed invention, “all the claim limitations must be taught or suggested by the prior art.” M.P.E.P. § 2143.03 *citing In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). Furthermore, “if an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious.” M.P.E.P. § 2143.03 *citing In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988).

As summarized above, example independent claim 1 as presently amended expressly recites “the optical modulator including a plurality of capacitors having charge modulated regions in the semiconductor substrate, wherein the optical beam is directed through the semiconductor substrate and through the charge modulated regions of the capacitors, the charge modulated regions of the capacitors in the semiconductor substrate to modulate the optical beam . . .” (emphasis added). Independent claims 19 and 25 expressly recite similar elements.

As also summarized earlier, although Lundqvist discloses that extracavity device 130 may be a modulator in paragraph 49, Lundqvist fails to disclose, teach or even fairly suggest

at least that the modulator includes a plurality of capacitors having charge modulated regions in the semiconductor substrate, wherein the optical beam is directed through the semiconductor substrate and through the charge modulated regions of the capacitors, the charge modulated regions of the capacitors in the semiconductor substrate to modulate the optical beam, as expressly recited in the Applicant's presently claimed invention.

Hung is directed to an integrated optic device for optical wavelength selection. The August 7, 2003 Office action remarks on page 6 that Hung "teaches that it is advantageous to use charge-modulated regions (created by electrodes 1314 and others not labeled) to control optical paths (col. 7, lines 57-col. 8, lines 10)." Gill is directed to electro-optic modulators. The August 7, 2003 Office action remarks on page 7 that Gill "teaches the use of trench capacitors to change the refractive index of the different path arms (fig. 14, electrodes). The August 7, 2003 Office action further remarks on page 7 that "one of ordinary skill in the art would recognize that any two parallel electrodes (disclosed in Hung) comprise a capacitor."

The Applicant submits that fair readings of Hung and/or Gill, whether taken singularly or in combination, fail to disclose teach or fairly suggest at least that the optical beam is directed through the semiconductor substrate and through the charge modulated regions of the capacitors, the charge modulated regions of the capacitors in the semiconductor substrate to modulate the optical beam, as expressly recited in the presently claimed invention. Moreover Applicant respectfully submits that both Hung and Gill actually teach away from the expressly claimed aspect of the optical beam being directed *through the charge modulated region of the capacitors*.

To illustrate, attention is kindly directed to for example Gill at column 3, lines 41-57, where Gill explains:

Consider a parallel plate capacitor with two dielectric

materials, "a" and "b" within the capacitor gap, with material "a" having a significantly smaller relative dielectric constant than material "b". Further, the two materials are arranged within the capacitor gap in a sandwich configuration so that material "a" is confined to the very center of the gap region, and material "b" fills the rest of the gap on either side of material "a". *The field distribution will be such that there will be a much larger field in the low dielectric material, material "a".* Stated another way, most of the voltage drop between the two capacitor plates will occur in the low dielectric material. *This analogy can be applied to the optical modulator shown in FIG. 6. If the dielectric constant of the modulator is reduced only in the optical waveguide region, a larger RF field, and therefore a larger RF/optical overlap, will be achieved in the device.*

(Emphasis added.) In the above-cited section of Gill, Gill teaches that the optical waveguide region is directed through the dielectric material of a capacitor. In particular, Gill describes a way to increase the voltage drop or field strength across the optical waveguide region in the dielectric material, which is between the two "parallel plates" of the capacitor. Therefore, the Applicant respectfully submits that Gill teaches that it is *advantageous* to direct the optical region *through the dielectric material* because of Gill's desired larger voltage drop between the two capacitor plates, which will result in an a larger RF field and therefore larger RF/optical overlap.

Continuing with Gill's analogy of a capacitor, the Applicant respectfully submits that one of ordinary skill in the art would recognize that the charged regions of a capacitor are the two "parallel plates." Stated differently, the dielectric region of a capacitor does *not* include charged regions. Indeed, one of ordinary skill in the art would recognize that the dielectric region of a capacitor is an *insulator* and is therefore necessarily substantially free of charge.

Therefore, since Gill teaches directing the optical waveguide region through the dielectric material of a capacitor, Gill fails to disclose, teach or fairly suggest at least that the optical beam is directed through the semiconductor substrate and through the charge

modulated regions of the capacitors, the charge modulated regions of the capacitors in the semiconductor substrate to modulate the optical beam, as expressly recited in the presently claimed invention.

With respect to Hung, even though the August 7, 2003 Office action remarks on page 6 that Hung “teaches that it is advantageous to use charge-modulated regions (created by electrodes 1314 and others not labeled) to control optical paths (col. 7, lines 57-col. 8, lines 10)” and that “one of ordinary skill in the art would recognize that any two parallel electrodes (disclosed in Hung) comprise a capacitor,” the Applicant respectfully submits that Hung nevertheless fails to disclose teach or fairly suggest at least that the optical beam is directed through the semiconductor substrate and through the charge modulated regions of the capacitors, the charge modulated regions of the capacitors in the semiconductor substrate to modulate the optical beam, as expressly recited in the presently claimed invention.

With regard to the “electrodes 1314 and others not labeled” or the “two parallel electrodes” disclosed in Hung, the Applicant believes the August 7, 2003 Office action is referring to the narrow rectangles with crosshatching that are parallel with the arms of the unbalanced MZI 1314 and/or the arms of the MZI modulator 1415 in Figures 3 or 4 of Hung. One of these narrow rectangles appears to be labeled “BIAS CONTROL” in Figure 4 while the others are indeed not labeled in Figures 3 and 4 or even discussed.

For the sake of discussion, if one assumes that these narrow rectangles with cross hatching identified in the August 7, 2003 Office action are “two parallel electrodes” or “plates” of a capacitor, then these electrodes would necessarily be *separated by a dielectric or insulating material* in order to form a capacitor as characterized in the August 7, 2003 Office action. Therefore, assuming further that capacitors are formed in Figures 3 and/or 4 of Hung with these “two parallel electrodes,” then it is observed that the optical paths in Hung

are routed between these “two parallel electrodes,” which would be *through the dielectric or insulating region of the capacitor*. As stated earlier with respect to Gill, the dielectric region of a capacitor does *not* include charged regions. Rather, the charged regions of a capacitor are located in the “plates.”

Therefore, Hung also fails to disclose, teach or fairly suggest at least that the optical beam is directed through the semiconductor substrate and *through the charge modulated regions of the capacitors*, the charge modulated regions of the capacitors in the semiconductor substrate to modulate the optical beam, as expressly recited in the presently claimed invention.

Sarlet, Liu and Kapany are all directed to tunable technologies. In particular, Sarlet is directed to a widely wavelength tunable integrated semiconductor device and method for widely wavelength tuning semiconductor devices. Liu is directed to a method and apparatus for tuning a Bragg grating in a semiconductor substrate. Kapany is directed to a tunable external cavity laser. However, Sarlet, Liu and Kapany, whether taken singularly or in combination, all fail to disclose, teach or fairly suggest at least modulating an optical beam with charge modulated regions of capacitors, wherein the optical beam is directed through the semiconductor substrate and through the charge modulated regions of the capacitors.

Therefore, since Lundqvist, Hung, Gil, Sarlet, Liu and Kapany, whether taken singularly or in combination, all fail to disclose, teach or fairly suggest at least that the optical beam is directed through the semiconductor substrate and through the charge modulated regions of the capacitors, the charge modulated regions of the capacitors in the semiconductor substrate to modulate the optical beam, as expressly recited in the presently claimed invention, the Applicant respectfully submits that the expressly claimed invention as presently amended is not obvious in view of all of the prior art references of record because

all the claim limitations are not taught or suggested by any of the prior art references of record, whether taken singularly or in combination. Thus, the Applicant respectfully requests that the instant section 103 rejections be withdrawn.

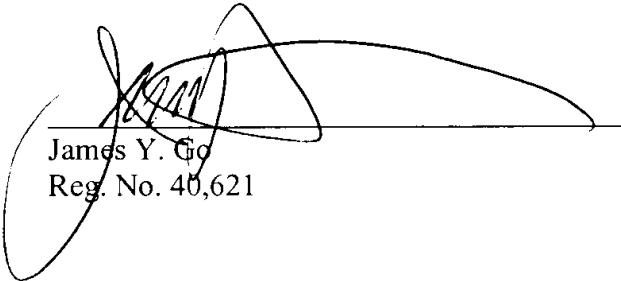
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The Applicants respectfully request that a timely Notice of Allowance be issued in this case.

Respectfully submitted,

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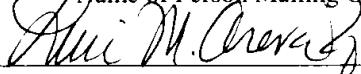
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